UTILITY	*Attorney Docket No.*	042390.P5379	*Total Pages (all documents)*	32
PATENT APPLICATION	*First Named Inventor or Application Identifier*			
TRANSMITTAL	Jerrold V. Hauck			
(Only for new nonprovisional applications under 37 CFR 1 53(b))	*Express Mail Label No.*	EM560651152US		

APPLICATION ELEMENTS
See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC   20231

1. [X] Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)

2. [X] Specification   *Total Pages* [14]
(preferred arrangement set forth below)
- Descriptive Title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R&D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings *(if filed)*
- Detailed Description
- Claims
- Abstract of the Disclosure

3. [X] Drawing(s) (35 USC 113)   *Total Sheets* [5]

4. [X] Oath of Declaration   *Total Pages* [4]
   a. [ ] Newly executed (original or copy)
   b. [ ] Copy from prior application (37 CFR 1.63(d))
   (for continuation/divisional with Box 17 completed)

   (Note Box 5 below)
   i. [ ] DELETION OF INVENTOR(S)
   Signed statement attached deleting inventor(s) named in prior application, see 37 CFR 1.63(d)(2) and 1.33 (b).

5. [ ] Incorporation By Reference *(usable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. [ ] Microfiche Computer Program *(Appendix)*

7. [ ] Nucleotide &/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   a. [ ] Computer Readable Copy
   b. [ ] Paper Copy (identical to computer copy)
   c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. [X] Assignment Papers (cover sheet & document(s))
9. [ ] 37 CFR 3.73(b) Statement [ ] Power of Attorney *(when there is an assignee)*
10. [ ] English Translation Document *(if applicable)*
11. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
12. [ ] Preliminary Amendment
13. [X] Return Receipt Postcard (MPEP 503)
14. [ ] Small Entity [ ] Statement filed in prior app Statement(s) Status still proper and desired
15. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. [ ] Other: ....

17. If a CONTINUING APPLICATION, *check appropriate box and supply the requisite information:*
[ ] Continuation   [ ] Divisional   [ ] Continuation-in-part (CIP) of prior application no:

18. CORRESPONDENCE ADDRESS

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FEE TRANSMITTAL

Note Effective October 1, 1997

Patent fees are subject to annual revision

Complete If Known

Application Number	
Filing Date	
First Named Inventor	**Jerrold V. Hauck**
Group Art Unit	
Examiner Name	

TOTAL AMOUNT OF PAYMENT	($)912.00	**Attorney Docket No.**	**042390.P5379**

METHOD OF PAYMENT (check one)

1. [X] The Commissioner is hereby authorized to charge indicated fees & credit any overpayments to:

Acct # | 02-2666

Acct Name | Blakely Sokoloff Taylor & Zafman

[X] Charge any add'l fee required under 37 CFR 1 16 & 1 17

[ ] Charge issue fee set in 37 CFR 1 18 at the mailing of the Notice of Allowance

2. [X] Payment Enclosed:

[X] Check   [ ] Money Order   [ ] Other

Fee Calculation

1. Filing Fee

Large Entity		Small Entity			Fee Paid
Code	Fee ($)	Code	Fee ($)	Fee Description	
101	790	201	395	Utility filing fee	790
106	330	206	165	Design filing fee	
107	540	207	270	Plant filing fee	
108	790	208	395	Reissue filing fee	
114	150	214	75	Provisional filing fee	

Subtotal (1) ($)790.00

2. Claims

		*	Extra		Fee from Below	Fee Paid
Total Claims	11	20 -	-0-	X		-0-
Ind. Claims	4	3 -	1	X		82.00
Multiple Dependent Claims						

Large Entity		Small Entity			
Code	Fee ($)	Code	Fee ($)	Fee Description	
103	22	203	11	Claims in excess of 20	
102	82	202	41	Independent claims in excess of 3	
104	270	204	135	Multiple dependent claim	
109	82	209	41	Reissue independent claims over original patent	
110	22	210	11	Reissue claims in excess of 20 & over original patent	

Subtotal (2) ($)82.00

FEE CALCULATION (continued)

3 Additional Fees

Large Entity		Small Entity			Fee Paid
Code	Fee ($)	Code	Fee ($)	Fee Description	
105	130	205	65	Surcharge-late filing fee or oath	
127	50	227	25	Surcharge-late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2520	147	2520	For filing a request for reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1840*	113	1840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within 1st month	
116	400	216	200	Extension for reply within 2nd month	
117	950	217	475	Extension for reply within 3rd month	
118	1510	218	755	Extension for reply within 4th month	
128	2060	228	1030	Extension for reply within 5th month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of appeal	
121	270	221	135	Request for oral hearing	
138	1510	138	1510	Petition to institute a public use proceeding	
140	110	240	55	Petition to Revive-unavoidable	
141	1320	241	660	Petition to Revive-unintentional	
142	1320	242	660	Utility issue fee (or reissue)	
143	450	243	225	Design issue fee	
144	670	244	335	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of IDS	
581	40	581	40	Recording each patent assignment per property	40.00
146	790	246	395	Filing a submission after final rejection	
149	790	249	395	For each add'l invention to be examined	

Other fee (specify) _____

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

Subtotal (3) ($)40.00

SUBMITTED BY				COMPLETE (if applicable)	
Name	Thomas M. Coester			Reg. Number	39,637
Signature	*Thomas Coester*	Date	4/10/98	Deposit Acct User ID	

*Highest number of claims previously paid for if an amendment is being transmitted.

UNITED STATES PATENT APPLICATION

FOR

EARLY ACKNOWLEDGMENT OF PRIMARY PACKETS

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BACKGROUND OF THE INVENTION

(1)   Field of the Invention

The invention relates to data transfer systems. More specifically the

5   invention relates to bandwidth reclamation on a full duplex bus.

(2)   Related Art

For high speed data transfers over a distance, various high speed serial

data transfer mechanisms have been developed. The IEEE Standard for a High

Performance Serial Bus, IEEE Std. 1394-1995 published August 30, 1996 (1394-1995

10   Standard) and its progeny provide a high speed serial protocol which permits

implementation of high speed data transfers. The existing progeny includes

P1394a Draft Standard for a High Performance Serial Bus (1394a Standard) and

P1394b Draft Standard for a High Performance Serial Bus (1394b Standard).

Generically, systems implementing 1394-1995, 1394a, 1394b or subsequent

15   revisions and modifications thereof are referred to herein as 1394 systems.

In 1394 systems a plurality of nodes are organized into a tree topology.

Additionally, all nodes are initially deemed peer to peer but on bus reset, one

node assumes root status while the remaining nodes become branches and

leaves of the topology. Both 1394-1995 and 1394a are half-duplex protocols.

20   Thus, data may only flow in one direction at any given time. Typically a primary

packet is sent by a source node out all ports. A downstream destination node

identifies from a header of the packet that the packet is directed to it. The

recipient then receives the packet and after the entire primary packet is received

and the acknowledge gap permits reversing the bus, an acknowledgment (ACK)

25   packet is sent to the source. If the packet is not completely received, the

destination node still waits until the transmission and ACK gap are complete before sending an ACK packet to the source indicating that the source should send the packet again later because the destination was busy or an error occurred.

Both of these protocols employ a discrete arbitration phase during which
5   all nodes seeking access to the bus send arbitration requests to the root node. The root node then resolves the arbitration and grants the bus to one of the arbitrating nodes. During this discrete arbitration phase no other useful work can be done on the bus.

The 1394b Standard provides a full-duplex serial bus protocol. Busses
10   employing the 1394b Standard may be able to reduce the ACK gap as the bus direction need not be reversed, but they still generally follow the primary packet/ACK scheme discussed above. Bus bandwidth is often a scarce resource. Efforts to improve bus efficiency are ongoing.

BRIEF SUMMARY OF THE INVENTION

An apparatus for improving bus efficiency is disclosed. A transceiver is provided. A state machine is coupled to the transceiver to generate a NAK

5 concurrently with the receipt of a packet when the packet cannot be successfully accepted.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of a physical layer of one embodiment of the invention.

Figure 2a and 2b are block diagrams of a transaction between a source and destination node in one embodiment of the invention.

Figure 3 is a block diagram of a tree topology of one embodiment of the invention.

Figure 4 is a flow diagram of source node activity in one embodiment of the invention.

Figure 5 is a flow diagram of destination node activity in one embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

A source node sends a primary packet toward a destination node along a full duplex bus. If the destination node identifies that it cannot receive the packet, it sends an acknowledgment (ACK) packet in the opposite direction along

5 the full duplex bus towards the source node. The ACK packet contains a code indicating that the packet could not be successfully accepted and should be retried later. The 1394a Standard defines acknowledge codes which stimulate a retry including ack_busy_*; ack_tardy; and ack_*_error. As used herein, an ACK packet containing such a code, or any other signal that a data transmission will

10 not be accepted and should be retried is termed a "NAK." Upon receiving the NAK, the source node aborts packet transmission of the primary packet which by virtue of the NAK has been identified as futile. Accordingly, the bandwidth which would have otherwise have been used for the futile packet transmission can be reclaimed and used for some other purpose.

15 Now referring to **Figure 1**, a physical layer (PHY) 10 has one or more ports which can be connected to a serial bus not shown. For each such port, per port logic 12 is provided as part of the PHY 10. The PHY 10 receives a receive signal 32 and transmits a transmit signal 34 through each active port. Per port logic 12 includes a decoder 22 to decode and descramble the incoming receive signal 32.

20 In one embodiment the decoder 22 is an 8B10B decoder and descrambler, which performs 8-bit 10-bit decoding. This means each 10-bit value coming in as the receive signal 32 is decoded into an 8-bit value. The decoder 22 is coupled to a port state machine 26 which receives a control value decoded by the decoder. Similarly, an encoder 24 is used to encode and scramble the outgoing transmit

25 signal 34. In one embodiment of the invention the encoder performs 8B10B encoding. Analogous to the decode case, each byte of data to be transmitted is

encoded as a 10-bit value. Thus, a number of codings exist that are not used for normal data encoding.

Additionally, the decoder 22 is coupled to an elasticity buffer 18. The elasticity buffer 18 buffers data decoded from the received signal 32 while that data is awaiting transfer to the link and/or repetition out on one or more ports of the PHY 10 as the transmit signal 34. The PHY state machine 14 and the arbitration state machine 16 may be combined as a single state machine or may be implemented as two separate state machines. The PHY state machine 14 provides the intelligence for the PHY including generation of any PHY generated packets. The arbitration state machine 16 assesses incoming arbitration information and provides outgoing arbitration requests. If the node is originating a packet on the bus it is the nominal root node. The nominal root node has complete arbitration state information for the topology. Based on this information the arbitration state machine 16 of the nominal root node grants the arbitration request of a highest priority branch. Since nominal root status passes with the grant of the bus, each node should be able to act as arbitrator for the topology. Copending application entitled "Distributed Arbitration on a Full Duplex Bus," Serial No. 09/017,451, describes at least one suitable embodiment of a distributed arbitration system. While much of the subsequent description is devoted to an embodiment in a distributed arbitration topology, the instant invention is also applicable to a non-distributed arbitration topology. For example, even in a system that uses a physical root node to conduct all arbitrations or those systems that continue to employ subaction gaps between each subaction, the invention provides significant bandwidth savings.

Figures 2a and 2b show a sample transaction in one embodiment of the invention. Source node 110 is transmitting a PACKETA 116 to destination node 112. Destination node 112 has determined that it cannot accept PACKETA 116.

The inability to accept might be caused by e.g., insufficient available resources. This can often be identified from the packet header, e.g., the packet header indicates that the packet is of a size that would exceed the destination buffer resources. While PACKETA 116 is still being transmitted to destination node

5   112, destination node 112 transmits a NAK 114 upstream to source node 110. Upon sending the NAK 114, the destination node asserts its arbitration request 120 on the upstream line. In **Figure 2b**, source node 110 having received NAK 114 previously, aborts PACKETA 116 and issues a grant 122 to the only requesting node, here destination node 112. By aborting the packet that must be resent later

10   the remaining packet time may be reclaimed and used for useful work.

In an alternative embodiment, which might be used where distributed arbitration is not available, the source node upon receiving the NAK aborts the packet. Then after a subaction gap all nodes may begin arbitrating through the physical root node. Because the start of the subaction gap occurs earlier in time

15   e.g., bus bandwidth is not wasted continuing to send a futile packet, bus efficiency is improved.

Figure 3 shows a system that includes a plurality of nodes 50-58. The nodes 50-58 are organized in a tree topology. In this topology node 50 is the physical root node. However, employing a distributed arbitration technique,

20   which node is the nominal root, nominal branches and nominal leaves depends on which node is permitted to originate a packet on the bus. The nodes are all interconnected by a full duplex serial bus 100. In one embodiment, serial bus 100 follows the 1394b protocol. Each node has one or more ports 30 through which communication between serial bus 100 and PHY 10 is conducted. The PHY 10

25   communicates with a link layer 36, which in turn communicates with a transaction layer 40.

In **Figure 3**, node 54 is transmitting a primary packet of a subaction (PACKETA) out all of its ports. Node 54 is therefore the nominal root node and receives arbitration information from each child node such that node 54 has the complete arbitration state of the topology available to it. Because node 54 is

5   transmitting a packet on the bus, the opposite directional path towards node 54 from nodes 50, 56 & 58 is available. In a distributed arbitration case, the other node will forward arbitration state information in this upstream direction. In **Figure 3**, it is presumed that the destination node is node 50. Node 50 having begun to receive PACKETA in a previous unit of time and identified an inability

10   to successfully accept PACKETA transmits a NAK to node 54. The NAK may be followed by arbitration state information. Upon receiving the NAK in a next unit in time, node 54 will abort PACKETA and grant the bus to another requester. Inasmuch as current primary packet time may approach 42 µsec at 800 Mbps, aborting a packet after e.g. 10 µsec can often result in substantial

15   opportunity to reclaim bandwidth. This is true even where the bus employs a discrete arbitration phase.

Figure 4 shows a flow chart of activity in the source node in one embodiment of the invention. At functional block 150, the source node begins transmitting a primary packet. If at decision block 152 a NAK has been received,

20   the source node aborts the transmission at functional block 154. If, however, no NAK has been received at decision block 152, a determination is made at decision block 156 if the transmission is complete. If the transmission is complete (e.g., an acknowledgment received) or after aborting transmission, the source node grants the highest priority of the arbitration request at functional block 158. If the

25   transmission is incomplete, the source node continues to transmit and watch for an incoming NAK.

Figure 5 shows a flow diagram of activity in a destination node of one embodiment of the invention. At functional block 170, the destination node begins receiving the primary packet transmitted by the source node. If an inability to successfully accept the packet is detected by the destination node at

5   decision block 172, a NAK is sent at functional block 174. Otherwise, a determination is made if the whole packet has been accepted at decision block 176. If the whole packet has been accepted, an ACK packet is sent at functional block 178 indicating the packet has been successfully accepted. If, however, the whole packet has not yet been accepted at decision block 176, the destination node

10   continues to receive and watch for an inability to complete packet acceptance.

In the foregoing specification, the invention has been described with reference to specific embodiments thereof. It will, however, be evident that various modifications and changes can be made thereto without departing from the broader spirit and scope of the invention as set forth in the appended claims.

15   The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense. Therefore, the scope of the invention should be limited only by the appended claims.

<u>CLAIMS</u>

What is claimed is:

1   1.   A method comprising the steps of:

2   transmitting a primary packet from a source node towards a

3 destination node on a full duplex bus;

4   receiving a NAK while the primary packet is being transmitted; and

5   aborting the transmission without sending all of the primary

6 packet.

1   2.   The method of claim 1 further comprising the step of:

2 reclaiming bandwidth not used as a result of the aborting step.

1   3.   The method of claim 2 wherein the reclaiming step comprises the

2 steps of:

3   granting the bus to a highest priority requesting node; and

4   beginning transmission of a next primary packet from the highest

5 priority requesting node.

1   4.   A method comprising the steps of:

2   receiving a primary packet at a destination node;

3   identifying, during the receiving step, that the node cannot

4 successfully accept the primary packet; and

5   sending a NAK to the originator of the primary packet concurrently

6 with the receiving step.

1   5.   A system comprising:

2   a full duplex bus;

3   a source node coupled to the bus, the source node to transmit a

4   primary packet; and

5   a destination node coupled to the bus, to receive the primary packet,

6   the destination node to generate a NAK if the primary packet cannot be

7   successfully accepted, the NAK generated concurrently with the receipt of the

8   primary packet.

1   6.   The system of claim 5 wherein the source node aborts a

2   transmission responsive to the NAK.

1   7.   The system of claim 6 further comprising:

2   a plurality of additional nodes coupled to the bus to form a tree topology

3   wherein the source node grants the bus to a highest priority requesting node

4   upon aborting the transmission.

1   8.   The system of claim 5 wherein an inability to accept the primary

2   packet is caused by unavailability of a needed resource.

1   9.   An apparatus comprising:

2   a transceiver;

3   a state machine coupled to the transceiver, the state machine to

4   generate NAK in response to an inability to successfully accept a primary packet,

5   the NAK generated concurrently with an ongoing arrival of the primary packet.

1   10.   The apparatus of claim 9 wherein the inability to accept is caused by
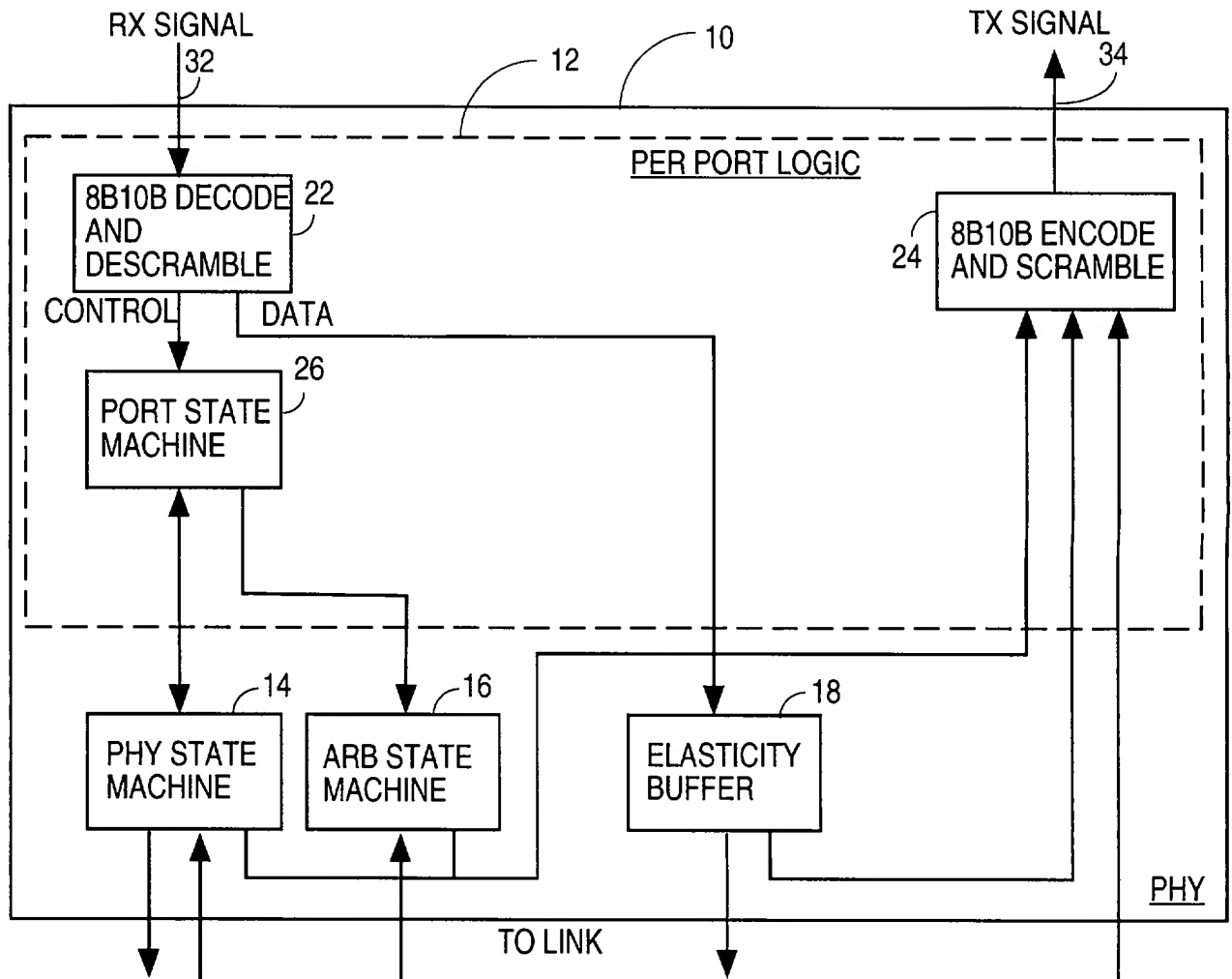
2   resource unavailability.

1   11.   The apparatus of claim 9 wherein when the apparatus is a source of

2   a primary packet, it aborts a transmission of the primary packet when a NAK is
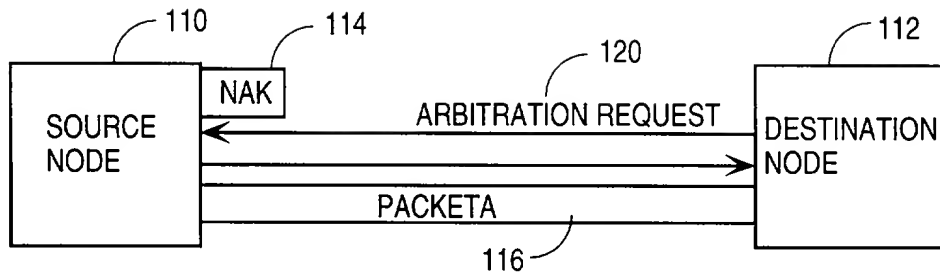
3   received.

ABSTRACT

A method and apparatus for reclaiming bus bandwidth on a full duplex bus. A source node sends a primary packet toward a destination node along a

5   full duplex bus. If the destination node identifies an inability to accept the primary packet, it sends a NAK in the opposite direction along the full duplex bus towards the source node. Upon receiving the NAK, the source node aborts packet transmission of the primary packet which by virtue of the NAK has been identified as futile. Accordingly, the bandwidth, which would have otherwise

10 have been used for the futile packet transmission, can be reclaimed and used for some other purpose.

RX SIGNAL
32

TX SIGNAL
34

12   10

PER PORT LOGIC

8B10B DECODE
AND
DESCRAMBLE   22

8B10B ENCODE
AND SCRAMBLE   24

CONTROL   DATA

PORT STATE
MACHINE   26

PHY STATE
MACHINE   14

ARB STATE
MACHINE   16

ELASTICITY
BUFFER   18

TO LINK

PHY

Fig. 1

Fig. 2a

Fig. 2b

Fig. 3

START

BEGIN PRIMARY PACKET
TRANSMISSION   150

NAK RECEIVED?   YES   ABORT TRANSMISSION
152   154

NO

TRANSMISSION
COMPLETE?
NO   156   YES

GRANT HIGHEST
PRIORITY
ARBITRATION
REQUEST   158

END

Fig 4

START

BEGIN RECEIVING
PRIMARY PACKET   170

UNABLE TO
ACCEPT?   172

YES

SEND NAK   174

NO

WHOLE PACKET
ACCEPT?   176

NO

YES

SEND ACK   178

END
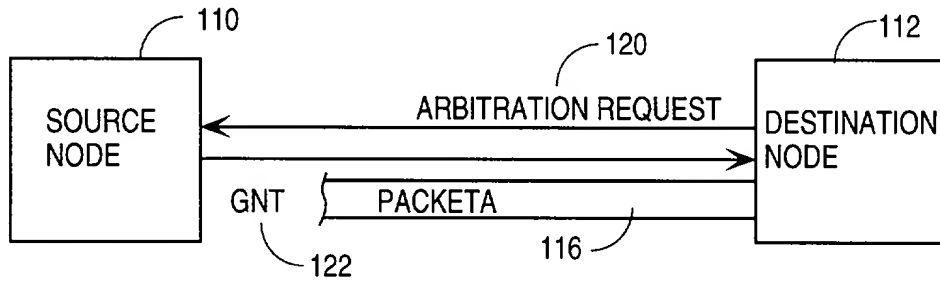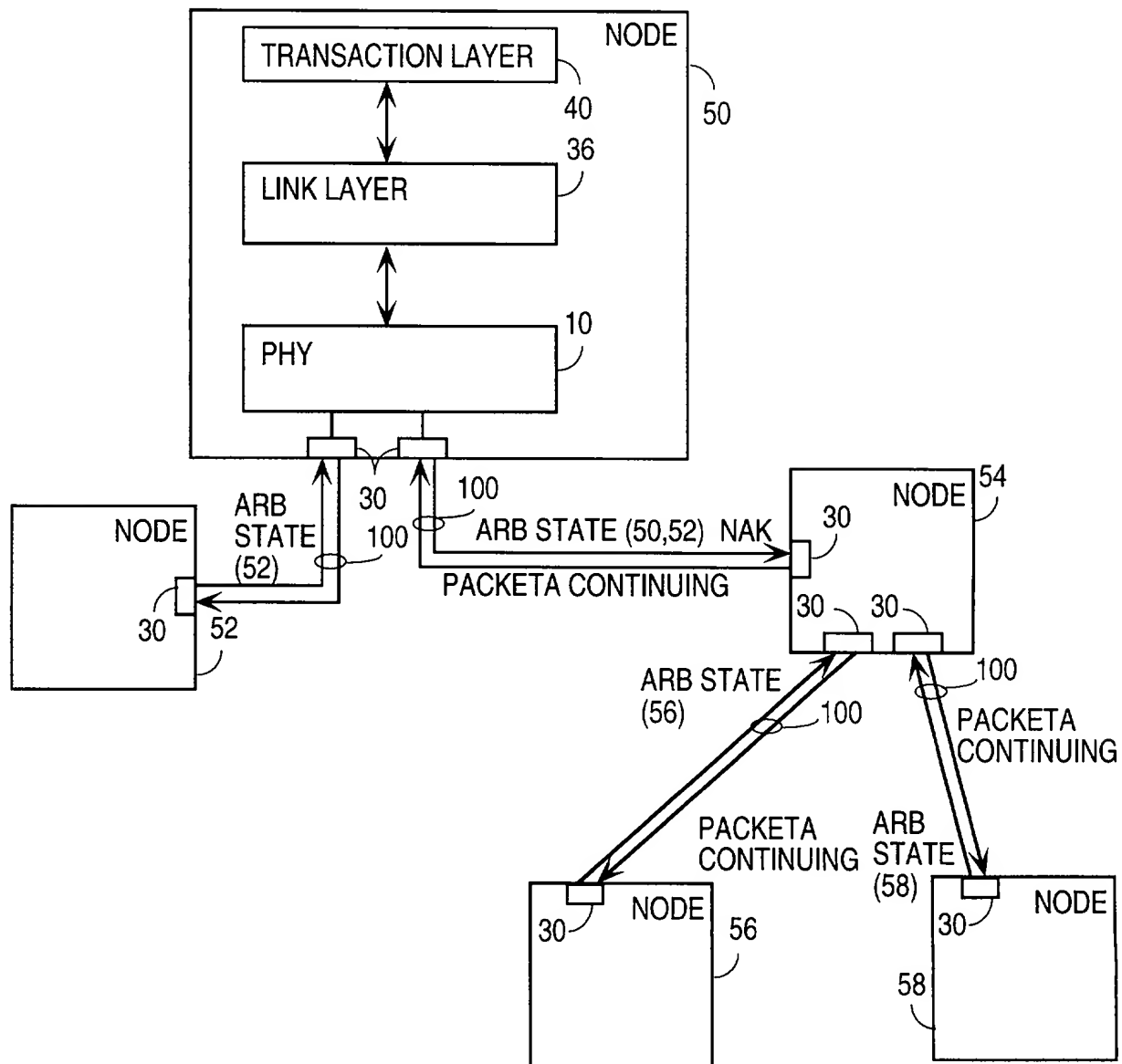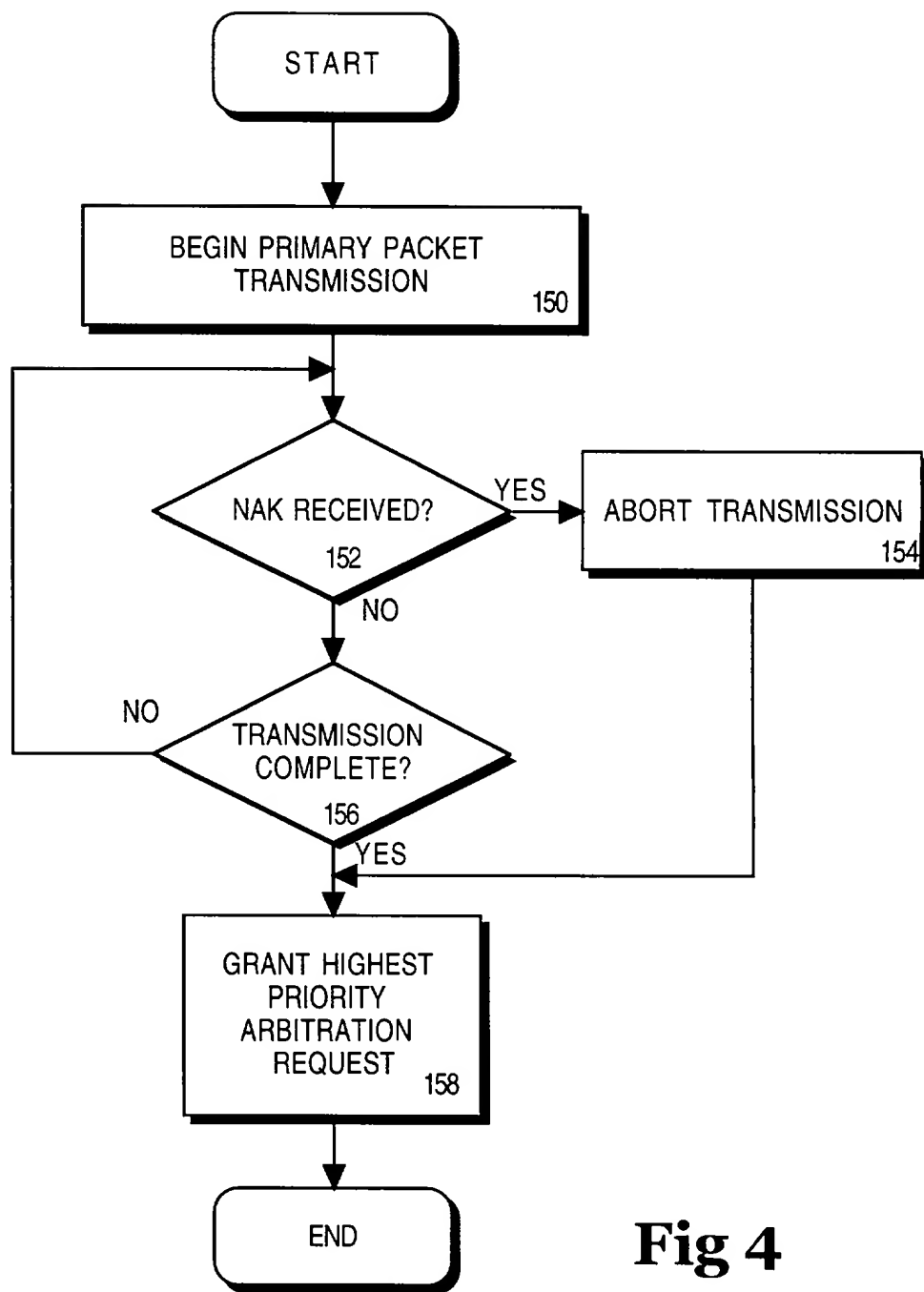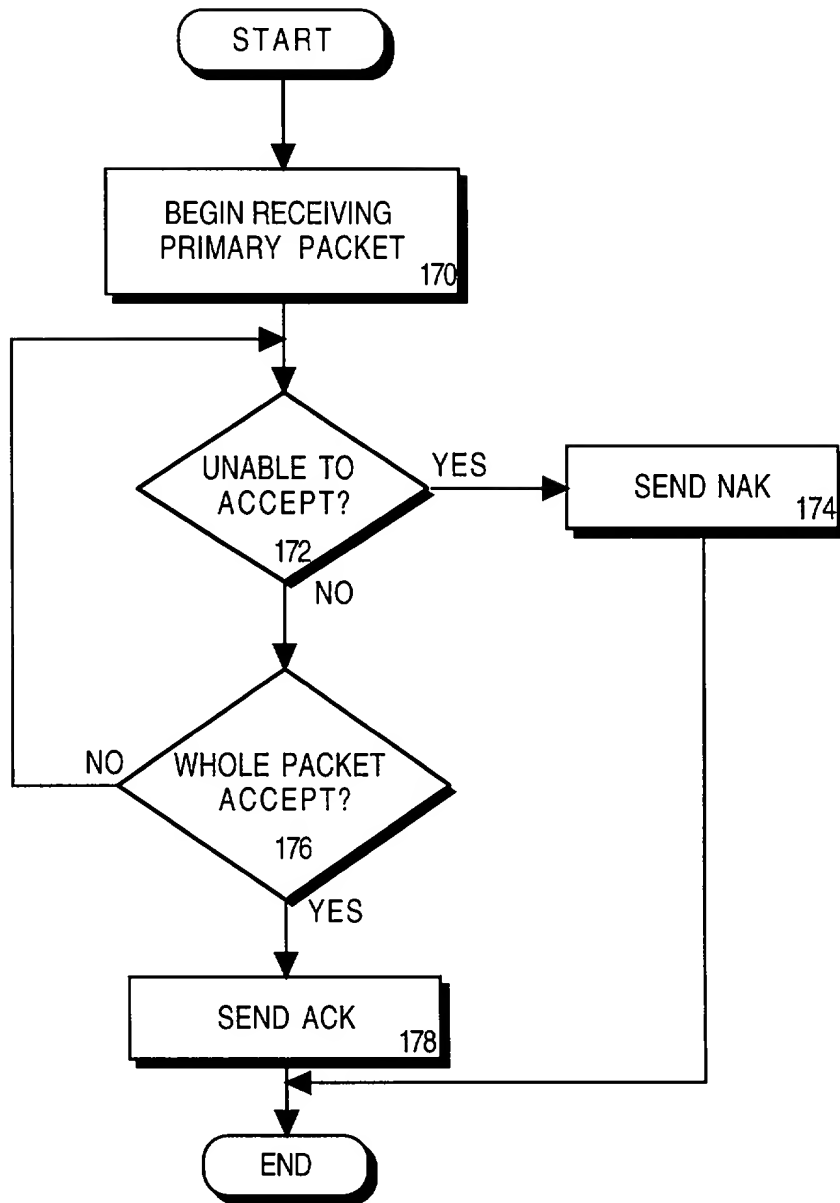
Fig. 5

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION
(FOR **INTEL CORPORATION** PATENT APPLICATIONS)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

the specification of which

    XXX is attached hereto.

    _____ was filed on _____ as

             United States Application Number _____

             or PCT International Application Number_____

             and was amended on _____.

                                       (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)   Priority Claimed

(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below

(Application Number)	Filing Date
(Application Number)	Filing Date

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:
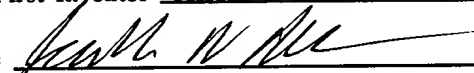
(Application Number)	Filing Date	(Status -- patented, pending, abandoned)

(Application Number)	Filing Date	(Status -- patented, pending, abandoned)

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclosure information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclosure all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1)   Prior art cited in search reports of a foreign patent office in a counterpart application, and

(2)   The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b)   Under this section, information is material to patentability when it is not cumulative to information already of record or being made or record in the application, and

(1)   It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2)   It refutes, or is inconsistent with, a position the applicant takes in:

(i)   Opposing an argument of unpatentability relied on by the Office, or

(ii)   Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c)   Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1)   Each inventor named in the application;

(2)   Each attorney or agent who prepares or prosecutes the application; and

(3)   Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d)   Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.